



Everybody was Kung-Fu fighting - The beneficial effects of Tai Chi Qigong and self-defense Kung-Fu training on psychological and endocrine health in middle aged and older men

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Abstract: Background: Higher age is associated to a variety of physical and mental disorders. Age-related changes in steroid secretion have been suggested to be an underlying mechanism leading to frailty, depression, and sexual dysfunction. However, Tai chi qigong and similar forms of exercise have been shown to improve a great variety of health-related parameters in older individuals. Methods: We examined 56 self-reporting healthy men actively practicing Tai chi qigong and/or self-defense Kung-fu and 55 age-matched self-reporting healthy controls. Saliva samples were obtained in a standardized procedure for subsequent quantification of circulating testosterone and cortisol levels. In addition, depressive symptoms, life satisfaction, and sexual health was assessed via self-report questionnaires. Results: Age was negatively associated with testosterone, while no association emerged for cortisol. Tai chi qigong and/or self-defense Kung-fu training was neither associated with testosterone nor cortisol. More weekly Tai chi qigong and/or self-defense Kung-fu training (4 or more times per week) was instead associated with a lower CT-ratio, less depressive symptoms, and higher life satisfaction compared to individuals, who trained only one to three times per week. More years of Tai chi qigong and/or self-defense Kung-fu training were associated with less depressive symptoms and higher life satisfaction but not with the CT-ratio. No significant associations emerged for Tai chi qigong and/or self-defense Kung-fu training and sexual health. When compared to the age-matched controls, there is a significant effect of Tai chi, qigong and/or self-defense Kung-fu on the CT-ratio. Contrast analyses revealed a significantly lower CT-ratio for the high training load group in contrast to the low training load group. Further, in contrast to the control group, the low training load group exhibits a significantly higher CT-ratio. For depression, contrast analyses revealed a significantly lower level of depression in the high training load group compared to the control group. Conclusion: The results indicate that Tai chi qigong and/or self-defense Kung-fu training is beneficially associated with steroid secretion patterns and mental health in aging men, when training is performed with a frequency of 4 or more trainings per week. However, the high frequency training and control group show similar steroid secretion patterns suggesting an inverted U-shaped association between Tai chi qigong and/or self-defense Kung-fu training frequency and the CT-ratio in aging men. More research is needed to elucidate the underlying mechanism of this association. Still, Tai chi qigong and/or self-defense Kung-fu training provides a promising prevention strategy against age-related physical and mental deterioration in aging men.

DOI: <https://doi.org/10.1016/j.ctim.2017.11.021>

Posted at the Zurich Open Repository and Archive, University of Zurich

ZORA URL: <https://doi.org/10.5167/uzh-143121>

Journal Article

Accepted Version

Originally published at:

Walther, Andreas; Lackner, Tim J; Ehlert, Ulrike (2018). Everybody was Kung-Fu fighting - The beneficial effects of Tai Chi Qigong and self-defense Kung-Fu training on psychological and endocrine health in middle aged and older men. *Complementary Therapies in Medicine*, 36:68-72.

DOI: <https://doi.org/10.1016/j.ctim.2017.11.021>

Accepted Manuscript

Title: Everybody was Kung-Fu fighting. . . – The beneficial effects of Tai Chi Qigong and self-defense Kung-Fu training on psychological and endocrine health in middle aged and older men

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PII: S0965-2299(17)30231-5
DOI: <https://doi.org/10.1016/j.ctim.2017.11.021>
Reference: YCTIM 1778

To appear in: *Complementary Therapies in Medicine*

Received date: 5-4-2017
Revised date: 29-11-2017
Accepted date: 29-11-2017

Please cite this article as: Walther A, Lackner TJ, Ehlert U. Everybody was Kung-Fu fighting. . . – The beneficial effects of Tai Chi Qigong and self-defense Kung-Fu training on psychological and endocrine health in middle aged and older men. *Complementary Therapies in Medicine* <https://doi.org/10.1016/j.ctim.2017.11.021>

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Article type:

Short report

Running head:

Tai Chi and steroid secretion in aging men

Everybody was Kung-Fu fighting... - The beneficial effects of Tai Chi Qigong and self-defense Kung-Fu training on psychological and endocrine health in middle aged and older men

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Complementary Therapies in Medicine

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Hightlights:

- Tai chi qigong is beneficially associated with steroid secretion in aging men.
- Tai chi qigong is beneficially associated with mental health in aging men.
- Tai chi qigong provides a promising prevention strategy for healthy aging in men.

Abstract

Background: Higher age is associated to a variety of physical and mental disorders. Age-related changes in steroid secretion have been suggested to be an underlying mechanism leading to frailty, depression, and sexual dysfunction. However, Tai chi qigong and similar forms of exercise have been shown to improve a great variety of health-related parameters in older individuals.

Methods: We examined 56 self-reporting healthy men actively practicing Tai chi qigong and/or self-defense Kung-fu and 55 age-matched self-reporting healthy controls. Saliva samples were obtained in a standardized procedure for subsequent quantification of

circulating testosterone and cortisol levels. In addition, depressive symptoms, life satisfaction, and sexual health was assessed via self-report questionnaires.

Results: Age was negatively associated with testosterone, while no association emerged for cortisol. Tai chi qigong and/or self-defense Kung-fu training was neither associated with testosterone nor cortisol. More weekly Tai chi qigong and/or self-defense Kung-fu training (4 or more times per week) was instead associated with a lower CT-ratio, less depressive symptoms, and higher life satisfaction compared to individuals, who trained only one to three times per week. More years of Tai chi qigong and/or self-defense Kung-fu training were associated with less depressive symptoms and higher life satisfaction but not with the CT-ratio. No significant associations emerged for Tai chi qigong and/or self-defense Kung-fu training and sexual health. When compared to the age-matched controls, there is a significant effect of Tai chi, qigong and/or self-defense Kung-fu on the CT-ratio. Contrast analyses revealed a significantly lower CT-ratio for the high training load group in contrast to the low training load group. Further, in contrast to the control group, the low training load group exhibits a significantly higher CT-ratio. For depression, contrast analyses revealed a significantly lower level of depression in the high training load group compared to the control group.

Conclusion: The results indicate that Tai chi qigong and/or self-defense Kung-fu training is beneficially associated with steroid secretion patterns and mental health in aging men, when training is performed with a frequency of 4 or more trainings per week. However, the high frequency training and control group show similar steroid secretion patterns suggesting an inverted U-shaped association between Tai chi qigong and/or self-defense Kung-fu training frequency and the CT-ratio in aging men. More research is needed to elucidate the underlying mechanism of this association. Still, Tai chi qigong and/or self-defense Kung-fu training provides a promising prevention strategy against age-related physical and mental deterioration in aging men.

Key words: aging, tai chi, qigong, kung-fu, steroid secretion, testosterone, cortisol, depression, satisfaction with life, sexual function

Introduction

Aging is accompanied by an increased risk for physical and mental disease such as frailty, dementia, sexual dysfunction, or depression.¹⁻³ As underlying mechanism contributing to this continuous health decline, age-related changes in steroid secretion have been suggested.^{4,5} In aging men testosterone (T), the end product of the hypothalamus-pituitary-gonadal (HPG)

axis, continuously declines,^{6,7} while cortisol (C), the primary effector of the hypothalamus-pituitary-adrenal (HPA) axis, continuously increases with age.^{8,9} Lower levels of T in men have been associated with depression, decreased life satisfaction, and sexual dysfunctions,^{10,11} while T-treatment showed significant improvements in mood and sexual function in older men.¹² In contrast, higher levels of C, and especially an elevated cortisol/testosterone (CTr) ratio reflecting the general (im)balance between the mutually inhibiting HPG and HPA axes, were shown to be associated with depression and overall worse health.^{13–15}

Tai Chi is considered health protective and was originally used as combatting style but slowly transformed to an exercise form aiming to perform soft, flowing, and mindful movements, which require balance, strength, agility, coordination, concentration, and flexibility. Beneficial effects of Tai chi with regard to sleep disturbances or frailty have been shown for older adults.^{16,17} Tai chi can be combined with qigong, which is a self-healing system including meditation, breathing techniques, movements, and stands. Tai chi qigong can be practiced by people across all age groups and has recently been shown to be especially effective in improving self-reported psychosocial factors (e.g. loneliness) and functional health in elderly.¹⁸ In addition, 12 weeks of Tai chi qigong have been shown to reduce C levels in patients with chronic schizophrenia and female cancer survivors.^{19,20} Furthermore, a 12-week Tai chi qigong program increased T levels in men aged 60 years or more with benign prostate hyperplasia.²¹

However, to date the potential protective effects of longterm Tai chi qigong practice on endocrine, psychological, and sexual outcomes in healthy older men have not been investigated. Furthermore, classical self-defense systems (e.g. Wing-chun or Eskrima), which require similar skills as Tai chi qigong such as strength, balance, concentration, have never been investigated for their health protective potential in healthy aging men.

Methods

56 self-reporting healthy men between 40 and 75 years practicing Tai chi qigong and self-defense Kung-Fu at the Suny Kamay Energy and Martial Arts Academy (SKEMA; www.skema.ch) and 55 age-matched self-reporting healthy male controls were recruited. This is a sub-sample of the Men's Health 40+ study fully described elsewhere.⁷ SKEMA is a Swiss martial arts academy providing standardized Tai chi qigong and self-defense trainings with a special focus on health maintenance in older individuals located in 25 different schools in Switzerland and Germany. The amount of years practicing Tai chi qigong and self-defense training (TYr) and the average amount of trainings per week (TWk) were used as continuous

vairables. The movement mode of Tai chi qigong can be described as soft and flowing movement sequences combined with holding certain positions, which focus on breathing. Both, Tai chi and Qigong are regarded as therapeutic exercise forms, which can be combined to enhance the training effect. In contrast, self-defense Kung-fu and here especially SKEMA Kung-fu is a martial art form, which is trained in groups including exercises to strengthen the body but also performing blocking and attacking techniques in a slow and conscious manner and once mastered in a fast and automatic manner. Thereby, the whole body is used similarly to Tai chi qigong by focusing on the stands, leg-work, as well as the trunk, the arms, and the head. Finally, all is combined to flowing movement sequences, which are trained in pairs to simulate an opponents' attack and ones' defense.

Salivary C and T were obtained via standardized saliva sampling between 8:00-8:15am and subsequent biochemical analysis at the biochemical laboratory of the Department of Psychology of the University of Zurich. As prior suggested, C and T were log transformed to subsequently calculate the CT-ratio.¹⁴ To measure depressive symptoms, the German version of the Center for Epidemiological Studies-Depression scale (CES-D) was used.^{22,23} Satisfaction with life was measured with the Satisfaction With Life Scale (SWLS),²⁴ while sexual function was measured with the International Index of Erectile Function.^{25,26} Pearson bivariate correlations and partial correlations were used for data analysis. The level of significance was set at $\alpha = .05$. A set of potential covariates was used in the partial correlation analyses including age, fat and muscle mass in percent, medication or other drug intake, smoking status, coffee consumption, general health perception, having had a cold within the last two weeks, and having had a gumbleeding during the last days. Ethical approval for the study protocol was given by the local ethics committee of the University of Zurich. All subjects provided a written consent for their participation in the study.

Results

Sample characteristics are presented in table 1. The 35 individuals in the group with one to three trainings per week have an average age of 51.83 (SD=8.83) years, while those in the group with four or more trainings per week show a mean age of 45.9 (SD=8.83) years. The BMI for the group with less trainings per week is 25.1 (SD=2.33) and for those with more training sessions per week BMI was 25.9 (SD=3.81). 88.6% of the group with fewer trainings per week reported to be non-smokers, while 66.7% in the group with more trainings per week reported to be non-smokers. For the healthy control group, average age was 49.95

(SD=7.469), BMI was 25.93 (SD=3.77), C was at average at 15.51 nmol/l (5.92), T was at average at 77.84 nmol/l (SD=27.83). The log-transformed CTr was at -1.63 (SD=0.48). Ten participants took medication, whereas 45 did not. There were 42 non-smokers and 13 smokers in the control group. Eight of the participants in the control group did less than an hour of exercise per week and 47 engaged in 1-3 hours of physical exercise per week. For the Asian martial arts group, age was negatively associated with T ($r = -.418, p = .001$), while for C no association emerged ($r = -.016, p = .456$). However, higher age was associated with a higher CT-ratio ($r = .253, p = .035$). Partial correlation analysis revealed a significant association for TWk and CT-ratio ($r = -.261, p = .045$), but not for TYr ($r = -.152, p = .166$). However, with regard to T correlation coefficients were positive for TWk ($r = .122, p = .217$) and TYr ($r = .047, p = .382$), but did not reach statistical significance. Correlation coefficients for the association between C and TWk ($r = -.096, p = .271$) and TYr ($r = -.117, p = .227$) were negative, but did not reach statistical significance either. Depressive symptoms were negatively associated with TYr ($r = -.337, p = .010$) and a negative trend emerged for TWk ($r = -.212, p = .077$). Life satisfaction was positively associated with TYr ($r = .360, p = .006$) and TWk ($r = .350, p = .008$), while for sexual dysfunction a negative trend emerged for TWk ($r = -.207, p = .087$), but not for TYr ($r = -.059, p = .351$). Further, t-tests for independent samples for CT-ratio and depressive symptoms were performed to investigate the differences between participants having 1-3 trainings per week and 4 or more trainings per week (Fig. 1). Results showed a significant difference ($t(51)=2.24, p=.019$) for the CT-ratio but not for depressive symptoms ($t(53)=1.96, p=.055$). The significant result points towards a lower CT-ratio for participants having a higher training load per week. Correlation analyses for the merged sample of healthy controls including the Asian martial arts groups showed a significant negative correlation with T ($r = -.370, p < .001$), no correlation with C ($r = -.024, p = .815$) and a significant positive correlation with CTr ($r = .262, p = .009$), taken together the results support the results of the sole Asian martial arts group.

Additionally to the t-tests for independent samples for the two training groups, a group comparison with the healthy age-matched control group with almost equal sample size ($N = 55$), was conducted. The control group engaging in either less than one hour or one to three hours of physical activity per week and was not practising Tai chi, Qigong or Kung-Fu. The oneway ANOVA showed a significant effect of Tai chi, Qigong and self-defense Kung-Fu training on the CT-ratio ($F(2, 95) = 4.992, p = .009$). A quadratic trend could be detected ($F(1, 95)=9.284, p=.003$), showing low CT-ratio for the control group and the high training load martial arts group, but a higher CT-ratio for the low training load martial arts group.

Results for C ($F(2, 95)=1.518, p=.224$), T ($F(2, 95)=828.036, p=.369$), depression scores ($F(2,107)=2.194, p=.116$) and satisfaction with life ($F(2, 107)=1.563, p=.214$) were not significant. Further, planned contrasts were calculated to test differences between the control and martial arts group in general, between the control group and the high training load martial arts group, and the control group and low training load group. Results for the comparison between control and the martial arts groups showed a trend towards significance for depression scores ($t(107)=-1.817, p=.072$) and satisfaction with life ($t(107)=1.657, p=.100$) but no significant effects for CT-ratio ($t(95)=1.324, p=.189$), C ($t(95)=1.078, p=.284$), T ($t(100)=-.503, p=.616$). Planned contrasts between the control group and the high training load martial arts group showed significantly lower scores of depression ($t(107)=2.095, p=.039$) and a trend towards higher satisfaction with life ($t(107)=-1.749, p=.083$) but no significant differences for CT-ratio ($t(95)=0.252, p=.801$), C ($t(95)=-.268, p=.789$), or T ($t(100)=-.200, p=.822$). The comparison between the control group and the low training load martial arts group showed a significant higher CT-ratio for the low training load martial arts group ($t(95)=2.888, p=.005$) and a trend in the same direction for C ($t(95)=1.714, p=.090$), but no significant results for T ($t(100)=-1.260, p=.210$), depression scores ($t(107)=-.572, p=.568$) or satisfaction with life ($t(107)=0.756, p=.444$). In addition, there was no significant difference in BMI between the groups ($F(2,100)=2.119, p=.126$). Nonparametric tests comparing the control group and the Tai chi, Qigong and self-defense Kung-Fu group showed no significant difference in smoking status either ($U=1441.5, p=.419$).

Conclusion

More trainings per week in Tai chi qigong and self-defense Kung-fu were associated with a lower CT-ratio, less depressive symptoms, and a higher life satisfaction, while for more years of training less depressive symptoms and a higher life satisfaction was observed. In comparison with a healthy control group, not practicing Tai chi, Qigong or Kung-Fu, participants with a low Asian martial arts training load exhibited the highest CTr, whereas the control group exhibits comparably low CTr than the high training load group.

The results of the comparison between high and low training load in Asian martial arts point to the conclusion that training in Tai chi qigong and self-defense Kung-fu might influence both, HPA and HPG activity in aging men by decelerating C-increase and T-decline. However, training (TYr and TWk) was not significantly associated with T nor C, but with the CT-ratio an integrated endocrine parameter including variance of both hormones.

However, taking a healthy control group into account, the conclusions become more

puzzling. The results, could be explained through a beneficial C increase in reaction to exercise, which increases the CTr without negative consequences, called the exercise-glucocorticoid paradox²⁷. The decreased CTr for higher training load can be explained through a simultaneous increase in T, which, in turn, decreases the CTr²⁸. Further, supporting this interpretation, depression scores in the low training load martial arts group are lower than in the control group, although these differences are not significant. Satisfaction with life is highest in the high training load group, with a trend towards statistical significance. Another explanation for the low CTr in the control group could be an increase in sex steroids as reaction of low intensity physical activity in low active individuals, followed by this increase, the CTr would decrease to a similar range than in the high training load martial arts group, but with a different underlying mechanism²⁸. Replicating these analyses with a larger sample size might lead to significant differences between the control and Asian martial arts groups, since the direction is as expected and a trend towards statistical significance can be detected.

Keeping in mind the small sample sizes, the effect of the training might only be detectable in the combined parameter, while for T or C alone a larger sample size or longitudinal data would be required. Furthermore, we replicated prior results, which showed Tai chi qigong training to improve psychosocial factors in older individuals.¹⁸ No significant associations with TYr or TWk were detected with regard to sexual health. However, negative trends emerged for TWk and sexual dysfunctions indicating larger a sample size might have revealed significant associations. When interpreting these results, it is important to consider some limitations of the study. First, the small sample size limits a generalization to a larger population and a replication in a larger sample is required. Further, causal inferences are not allowed since the data is of cross-sectional nature. Longitudinal data confirming a decline of the CT-ratio and depressive symptoms with an increase in training sessions of self-defense Kung-fu and Tai chi qigong are needed. Finally, salivary steroids sampled at 8:00 a.m. represent a point measure, while diurnal profiles with more sampling time points or hair steroids might be more adequate to reflect an individuals' hormonal state.

We here provide first results for a potential underlying biological mechanism through which training of Tai chi qigong and self-defense Kung-Fu might cause its overall beneficial effects in aging men – namely by buffering age-related alterations in the HPA and HPG axes.

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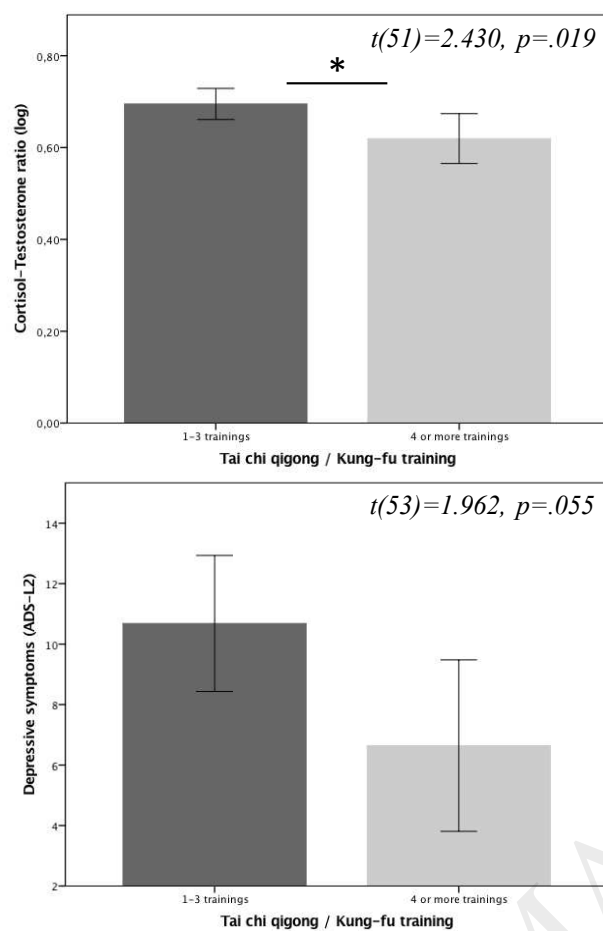


Fig. 1. T-tests for the groups 1-3 trainings per week versus 4 or more trainings per week for the CT-ratio (top) and depressive symptoms (bottom).

Table 1. Sample characteristics			
Characteristic	n	M (SD)	%
Age	111	49.8 (7.9)	
BMI (kg/m ²)	103	25.5 (3.4)	
Cortisol (nmol/L)	98	16.6 (6.8)	
Testosterone (nmol/L)	103	74.2 (28.7)	
Cortisol-Testosterone-Ratio (log)	98	-1.5 (0.5)	
Medication intake (No/Yes)	93/18		83.8/16.2
Smoking status (No/Yes)	87/24		78.4/21.6
Training per week (in h)	56	4.4 (4.9)	
Years of training	56	10.8 (8.7)	
<i>Training type</i>			
Tai chi qigong	18		32.1
Self-defense Kung-Fu (Wing-chun, Eskrima)	19		33.9
Both training types	19		33.9